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183

**STATE OF ALASKA 1987 LEGISLATIVE SESSION  
FISCAL NOTE**

**REQUEST:** \_\_\_\_\_  
 Revision Date: \_\_\_\_\_  
 Title: "An Act relating to dams and reservoirs..."  
 Sponsor: Sen. Sturgulewski  
 Requestor: Senate Transportation

Bill Version: SB 183  
 Publish Date: \_\_\_\_\_  
 Agency Affected: Department of Law  
 BRU: Prosecution, Legal Services  
 Components: Prosecution - All  
Legal Services - Operations

**EXPENDITURES/REVENUES: (Thousands of Dollars)**

OPERATING	FY 87	FY 88	FY 89	FY 90	FY 91	FY 92
PERSONAL SERVICES						
TRAVEL						
CONTRACTUAL						
SUPPLIES						
EQUIPMENT						
LAND & STRUCTURES						
GRANTS, CLAIMS						
MISCELLANEOUS						
<b>TOTAL OPERATING</b>		-0-	-0-	-0-	-0-	-0-
<b>CAPITAL</b>						
<b>REVENUE</b>						

**FUNDING: (Thousands of Dollars)**

GENERAL FUND		-0-	-0-	-0-	-0-	-0-
FEDERAL FUNDS						
OTHER						
<b>TOTAL</b>						

**POSITIONS:**

FULL-TIME		-0-	-0-	-0-	-0-	-0-
PART-TIME						
TEMPORARY						

**ANALYSIS : (Attach a separate page if necessary)**

Please see attached analysis.

Prepared by: Richard I. Pegues, Director Phone: 465-3672  
 Division: Administrative Services Date: March 18, 1987  
 Approved by Commissioner: Grace Berg Schaible, Atty. Gen. Date: March 18, 1987  
 Agency: Department of Law

**Distribution (by preparer):**

- Legislative Finance
- Legislative Sponsor
- Requestor
- Office of Management and Budget
- Impacted Agency(ies)
- Senate Secretary

## CONTINUATION of FISCAL NOTE ANALYSIS

For Bill/Resolution No. SB 183

This bill amends AS 46 by adding a new chapter that establishes a dam safety Act, which provides for the regulation, supervision, and periodic inspection of privately owned and state-owned dams and reservoirs. The Department of Law would assist the Department of Natural Resources to administer the Act by securing court injunctions needed to halt unsafe practices, and by prosecuting misdemeanor violations.

Although some of this work will undoubtedly be required, it is our view that such work will entail only a few occurrences each year, and it will not be sufficient to warrant fiscal note costs.

**STATE OF ALASKA 1987 LEGISLATIVE SESSION  
FISCAL NOTE**

**REQUEST:** \_\_\_\_\_

Bill Version : SB 183  
Publish Date : \_\_\_\_\_

Revision Date: \_\_\_\_\_  
Title: Relating to dams and reservoirs

Agency Affected: Environmental Conservation  
BRU: N.A.

Sponsor: Senator Sturqulewski  
Requestor: Senator Jones--Transportation

Components : N.A.

**EXPENDITURES/REVENUES: (Thousands of Dollars)**

OPERATING	FY 87	FY 88	FY 89	FY 90	FY 91	FY 92
PERSONAL SERVICES						
TRAVEL						
CONTRACTUAL						
SUPPLIES						
EQUIPMENT						
LAND & STRUCTURES						
GRANTS, CLAIMS						
MISCELLANEOUS						
<b>TOTAL OPERATING</b>	-0-	-0-	-0-	-0-	-0-	-0-
<b>CAPITAL</b>	-0-	-0-	-0-	-0-	-0-	-0-
<b>REVENUE</b>	-0-	-0-	-0-	-0-	-0-	-0-

**FUNDING: (Thousands of Dollars)**

GENERAL FUND						
FEDERAL FUNDS						
OTHER						
<b>TOTAL</b>	-0-	-0-	-0-	-0-	-0-	-0-

**POSITIONS:**

FULL-TIME						
PART-TIME						
TEMPORARY						

**ANALYSIS :** (Attach a separate page if necessary)

Prepared by: Randy Bayliss  
Division: Office of the Commissioner

Phone: 465-2600  
Date: March 17, 1987

Approved by Commissioner: \_\_\_\_\_  
Agency: Environmental Conservation

Date: 3/18/87

- Distribution (by preparer):
- Legislative Finance
  - Legislative Sponsor
  - Requestor
  - Office of Management and Budget
  - Impacted Agency(ies)
  - Senate Secretary

**STATE OF ALASKA 1987 LEGISLATIVE SESSION  
FISCAL NOTE**

Bill Version: Senate Bill No. 183  
Publish Date: 3/12/87

REQUEST: --  
\_\_\_\_\_  
Revision Date: \_\_\_\_\_  
Title: An act relating to dams and  
reservoirs  
Sponsor: Sturgulevski  
Requestor: \_\_\_\_\_

Agency Affected: Natural Resources  
BRU: Land and Water Management  
Components: Land and Water Public Use

**EXPENDITURES/REVENUES: (Thousands of Dollars)**

OPERATING	FY 87	FY 88	FY 89	FY 90	FY 91	FY 92
PERSONAL SERVICES	0	0	0	0	0	0
TRAVEL	0	0	0	0	0	0
CONTRACTUAL	0	0	0	0	0	0
SUPPLIES	0	0	0	0	0	0
EQUIPMENT	0	0	0	0	0	0
LAND & STRUCTURES	0	0	0	0	0	0
GRANTS, CLAIMS	0	0	0	0	0	0
MISCELLANEOUS	0	0	0	0	0	0
TOTAL OPERATING	0	0	0	0	0	0
CAPITAL	0	0	0	0	0	0
REVENUE	0	0	0	0	0	0

**FUNDING: (Thousands of Dollars)**

GENERAL FUND	0	0	0	0	0	0
FEDERAL FUNDS	0	65.0	65.0	65.0	65.0	65.0
OTHER	0	0	0	0	0	0
TOTAL	65.0	65.0	65.0	65.0	65.0	65.0

**POSITIONS:**

FULL-TIME	0	0	0	0	0	0
PART-TIME	0	0	0	0	0	0
TEMPORARY	0	0	0	0	0	0

**ANALYSIS :** (Attach a separate page if necessary)  
Senate Bill No. 183 will qualify DWR's Dam Safety Program to qualify for at least \$65.0 federal funding under P.L. 99-662 for five years. No increases in state expenditures will occur as a result of this legislation.

Prepared by: Kyle J. Cherry Phone: 562-3332  
Division: Land and Water Management. Date: 3/26/87

Approved by Commissioner: \_\_\_\_\_ Date: \_\_\_\_\_  
Agency: \_\_\_\_\_

Distribution (by preparer):  
Legislative Finance  
Legislative Sponsor  
Requestor  
Office of Management and Budget  
Impacted Agency(ies)  
Senate Secretary

# ALASKA STATE LEGISLATURE

Sen. Lloyd Jones, Chairman  
Sen. John B. "Jack" Coghill, Vice Chairman  
Sen. Mitch Abood  
Sen. Bettye Fahrenkamp  
Sen. Tim Kelly



P.O. Box V  
Juneau, AK 99811

907-465-4921

## Senate Transportation Committee

### COMMITTEE REPORT

Madame President:

The transportation committee expresses that it is not the intent, either through Senate Bill 183, nor through regulations, that the bill affect settling ponds of small placer miners.

The transportation committee also asks to see and review the regulations that are promulgated to implement the legislation.

Sincerely,

A handwritten signature in cursive script, appearing to read "Lloyd Jones", is written over a horizontal line.

Senator Lloyd Jones, Chairman  
Senate Transportation Committee

SENATE COMMITTEE REPORT

FIRST COMMITTEE OF REFERRAL

Date of March 26, 1987 75-DAY NOTICE  
IN ACCORDANCE WITH UNIFORM RULE 23

\*\*FISCAL NOTE(S) ATTACHED  \*\*  
IN ACCORDANCE WITH AS 24.08.035  
(see below)

FURTHER: RESOURCES  
FINANCE

3/12/87

DATE TURNED INTO OFFICE April 2, 1987

Mr. President:

TRANSPORTATION

Committee considered SB 183

dams and reservoirs; efd.

and recommended:

- replace with CS \_\_\_\_\_  same title
- attached amendment(s) and  new title
- do pass
- do not pass
- no recommendation
- individual recommendations
- further referral to \_\_\_\_\_
- letter of intent adopted and attached

\*\* Committee  attached or  adopted fiscal note(s)  
2  zero /  fiscal impact

MEMBERS SIGNING DO PASS

OTHER RECOMMENDATIONS

Tim 1987  
[Signature]  
[Signature]  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

[Signature] Do Pass  
Chairman signature and recommendation

Committee Backup Attached

# Alaska State Legislature



SENATOR  
ARLISS STURGULEWSKI

Chairman, Senate Community and Regional Affairs Committee  
Vice-Chairman, Senate Judiciary Committee  
Member, Senate Resources Committee

2957 SHELDON JACKSON STREET  
ANCHORAGE, ALASKA 99508


While in Juneau  
P. O. BOX V  
JUNEAU, ALASKA 99811  
(907) 465-1818

## Senate

MEMORANDUM

March 28, 1987

TO: Senator Lloyd Jones, Chairman  
Senate Transportation Committee

FROM: Senator Arliss Sturgulewski   
Senate District F

RE: SB 183 "An Act relating to dams and reservoirs and providing for  
an effective date."

Thank you for scheduling a hearing on SB 183 "An Act relating to dams and reservoirs and providing for an effective date."

Senate Bill 183 was before the legislature last year and extensive hearings were held. However at the end of last session the bill was still in the Senate Finance Committee. Senate Bill 183 sets up a formal system of regulation of dams by the Department of Natural Resources (DNR). Presently the DNR only has clear authority to regulate construction activities and no clear authority to monitor the safety of dams throughout the life of the dam. This legislation is based on a Model State Dam Safety Program sponsored by the Association of State Dam Safety Officials and the Council of State Governments. The main purpose of this legislation is to protect the public health and safety.

In order to assist states in the implementation of a dam safety program, the federal government will make funds available through PL 99-662. Alaska would be eligible to receive at least \$65,000 per year for the next five years.

I have enclosed a sectional analysis prepared by the Legislative Legal Services Division and a recent Wall Street Journal article discussing dam safety. My staff is available to assist if you need additional information.

Enclosures

STATE OF ALASKA  
THE LEGISLATURE

POUCHY STATE CAPITOL  
JUNEAU, ALASKA 99801  
907 465 3800

LEGISLATIVE AFFAIRS AGENCY

MEMORANDUM

March 27, 1987

SUBJECT: Sectional Analysis of SB 183  
(Dams and reservoirs)

TO: Senator Arliss Sturgulewski  
Chairman, Community and Regional Affairs  
Committee

FROM: Teresa B. Cramer *TBC*  
Legislative Counsel

You have requested a sectional analysis of the above described bill.

As a preliminary matter, I must advise you that a sectional analysis or summary of a bill should not be considered an authoritative interpretation of the bill and the bill itself is the best statement of its contents.

Section 1 imposes criminal penalties for knowingly making a false report to the Department of Natural Resources concerning the condition of a dam or reservoir.

Section 2 adds a new chapter concerning dam and reservoir safety.

Sec. 36.17.010 sets out the legislative purpose.

Sec. 46.17.020 gives the Department of Natural Resources responsibility for supervising the safety of dams and reservoirs.

Sec. 46.17.030 requires the department to adopt regulations and issue orders necessary to carry out the chapter.

Sec. 46.17.040 prohibits construction, repair, or removal of a dam or reservoir unless the department approves. Routine maintenance and operations are excepted.

- Sectional Analysis -

Sec. 46.17.050 directs the department to inspect each dam and reservoir subject to the chapter once every five years and permits the department to inspect more frequently. The department may require the owner to perform the inspection or pay for the cost of an inspection performed by the department.

Sec. 46.17.060 permits the department to seek a search warrant to allow an inspection if the department has given two weeks' written notice. The department may enter premises without notice if a dam or reservoir is believed to be unsafe.

Sec. 46.17.070 sets out standards for the department's determination of whether a dam or reservoir constitutes or would constitute a danger to life or property.

Sec. 46.17.080 permits the department to seek an injunction and damages in enforcing the chapter.

Sec. 46.17.090 subjects a final action of the department to judicial review under the Administrative Procedure Act.

Sec. 46.17.100 permits the department to enter into cooperative agreements with other governments and prohibits municipalities from exercising powers that conflict with the powers and duties given the department. Under subsections (c) and (d), the chapter does not apply to a federally-owned or operated dam or reservoir and does not affect the powers of the Department of Environmental Conservation or the Department of Fish and Game.

Sec. 46.17.110 limits actions against the state. An action may be maintained against the state if the state negligently orders a dam owner to perform an action and the dam owner complies with the order but objected to it.

Sec. 46.17.120 acknowledges that the chapter does not relieve an owner of a dam or reservoir of the duties or liabilities incident to the ownership or operation of the dam or reservoir.

Sec. 46.17.150 imposes penalties on persons who knowingly violate the chapter, an approval, order, regulation, or requirement of the department, or who obstruct performance of duties

Senator Sturgulewski  
Page 3  
March 27, 1987

Sec. 46.17.900 is a definition section.

Section 3 is an immediate effective date clause.

If I may be of further assistance, please advise.

TBC:mkr  
m10/065

March 30, 1987

The Honorable Arliss Sturgulewski  
Sponsor of Senate Bill 183  
Alaska State Legislature  
P.O. Box V  
Juneau, AK 99801

Dear Senator Sturgulewski:

Subject: Senate Bill 183, relating to supervision of safety of dams and reservoirs.

Position: The Department of Natural Resources recommends the passage of Senate Bill 183.

Background: Currently, there are 185 dams on Alaska's dam inventory. In 1981, the U.S. Department of the Army, Corps of Engineers, ended its dam safety program for non-federal dams in Alaska. There are but 20 federal dams in Alaska. The remaining dams are covered under a minimal dam safety program the Department of Natural Resources, division of land and water management, established through regulations. The department adopted regulations in 11 AAC 93 under the authority of several sections in AS 46.15, the Alaska Water Use Act, including a provision in AS 46.15.080 which gives the commissioner authority to regulate water diversions.

Alaska Water Resources Board resolution 84-4, dated March 14, 1984, recommended review of the existing statutory authority under which dams in the state are regulated by the division.

About half of the 50 states have enacted specific dam safety legislation, but most of these states did so in response to dam failures resulting in loss of life and extensive property damage. Clearly it would be advantageous for Alaska to have a well-founded, comprehensive dam safety statutory scheme and program in effect to prevent such tragedies from occurring here. SB 183 is based on the Model Law for State Supervision of Safety of Dams and Reservoirs drafted by the United States Committee on Large Dams of the International Commission on Large Dams.

- POSITION Paper -

Section 2, which contains the body of the bill, creates a new ch. 17 in AS 46. Proposed AS 46.17.010 first states the purpose of the chapter. It then makes the supervision of safety of dams and reservoirs the responsibility of the Department of Natural Resources. The commissioner of that department is directed to employ a qualified engineer experienced in the design and construction of dams and reservoirs to direct the dam safety program. Proposed AS 46.17.040 would make it unlawful for anyone to construct, enlarge, repair, alter, remove, maintain, operate, or abandon a dam or reservoir, as defined in the bill, except upon application to, and approval of, the department. To ensure that dams and reservoirs remain safe once constructed, the department is directed in proposed AS 46.17.050 to inspect or to require owners to inspect dams and reservoirs covered under the bill at least once every five years, or more frequently if necessary. To ensure that it can make adequate inspections, the department is also given authority, in proposed AS 46.17.060, to enter the private property on which the dam or reservoir is located as might be necessary to make the inspection. Proposed AS 46.17.050 also authorizes the department to require owners to bear the costs of inspection.

Proposed AS 46.17.070 sets out specific standards for determining the safety of a dam or reservoir. In addition, the department is allowed, by proposed AS 46.17.110, to enter into cooperative management agreements with municipal corporations and other state and federal agencies to effectuate its responsibilities under the bill. To ensure that the state's action in inspecting and regulating the operation of dams or reservoirs does not shift the liability of the private owner to the state for loss of life or property damage due to a dam or reservoir failure, proposed AS 46.17.120 bars any action against the state based on any purported act or omission of a state agent or employee connected with the dam safety program.

Section 1 of the bill amends AS 11.56.800(a), dealing with the crime of making a false report. A new paragraph (4) will make it a crime to file a false report with the Department of Natural Resources concerning the condition of a dam or reservoir. Additional criminal sanctions are also contained in sec. 2 of the bill in proposed AS 46.17.100, which would make it a class A misdemeanor to violate any provision of AS 46.17 or lawful order the department issues under AS 46.17.

The Honorable Arliss Sturgulewski -3-

March 30, 1987

Recommendation: Given the importance of a good dam safety program to the State of Alaska, the Department of Natural Resources favors passage of this legislation.

Sincerely,

Judith M. Brady  
Commissioner

cc: Senate Transportation Committee  
George Sullivan  
Rod Swope

# THE WALL STREET JOURNAL

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WESTERN EDITION

THURSDAY, MARCH 19, 1987

FEDERAL WAY, WASHINGTON

## Flood Watch

### Dams' Safety Worries Officials Who Believe Repairs Are Lagging

Earthquakes and Other Risks  
Give Nightmares to Some  
Despite a Recent Respite

### Stitching Up a TVA Crack

By BRUCE INGERSOLL

*Staff Reporter of THE WALL STREET JOURNAL*  
MONCKS CORNER, S.C. — The 1983 dam scare here is remembered as "the peril at Pinopolis."

On a languid summer morning, the West Pinopolis Dam suddenly sprang an enormous leak, setting off alarms in the powerhouse. While the police rapped on doors to evacuate downstream residents, emergency workers struggled to keep the huge dam from collapsing. They tried plugging the leak with weighted bales of hay. They tried steel plates. Increasingly desperate, they bought a furniture store's entire stock of mattresses, only to find them too buoyant. Finally, they slapped together a makeshift dam with pile-driven utility poles.

A disaster was averted—for the time being. But federal dam regulators worry that West Pinopolis is one of many dams around the country that would collapse if a severe earthquake hit. Hundreds of dams couldn't withstand a major flood. Thousands more have fallen into disrepair, some leaking or slumping so badly that they are in danger of collapse.

"One of these times, Mother Luck isn't going to hold," warns William Bivins, the dam safety coordinator for the Federal Emergency Management Agency. "One of these high-hazard dams is going to pop at night when everybody is asleep in bed. It will wipe out hundreds of people."

#### Recent Dam Breaks

But to some top officials, warnings about dam disasters are overblown, and in most states public interest in dam safety is low. In the 1970s, nearly 500 people died in six major U.S. dam breaks, but in the 1980s the fatalities have been few in this country, though a 1985 dam break in Italy killed more than 220 people.

Meanwhile, dam safety initiatives have been slowed by tight budgets, bureaucratic inertia and the lack of a political constituency. "All of our constituents are dead people," says safety advocate Bruce Tschantz, a professor of civil engineering at the University of Tennessee.

Of the 80,000 or so dams in the U.S., about 8,000 are owned or regulated by federal agencies. The rest are owned by farmers, ranchers, developers, utilities or states and municipalities. Most major dams are owned and maintained by big agencies such as the Pentagon's Army Corps of Engineers and the Interior Department's Bureau of Reclamation.

The bureau is still haunted by the 1976 collapse of the Teton Dam in Idaho as it was being filled for the first time, killing 11 people. One-fifth of the bureau's 300 dams, all in the West, are classified as unsafe. Critics say the bureau doesn't treat dam safety as a priority. Bureau officials disagree, but since 1980 the agency has spent only 11% of \$750 million authorized by Congress for safety "modifications."

Internal documents obtained from the Corps of Engineers, meanwhile, show that a superflood would overwhelm at least 20 of that agency's 600 dams, engulfing such communities as Houston and Valley City, N.D. The corps is also studying how well several structures, including two dikes on the Clemson University campus in South Carolina, would hold up in a major earthquake. If the dikes failed, the football stadium, dubbed "Death Valley" by Clemson's foes, would be swamped. Overall, "We are concerned about 36 dams," says Lloyd Duscha, the corps' deputy director of engineering and construction.

Remedial efforts have been limited, however. Some cost-conscious Reagan administration appointees haven't shared agency engineers' sense of urgency. "Bureaucratic engineers always try to figure out a way to perpetuate themselves and build up their budgets," asserts William Giarelli, who in recent years oversaw the corps as assistant Army secretary for civil works.

#### Underfunded and Undermanned

On the state level, the number of unsafe dams has been reduced to 1,948 from about 2,900 in 1981, according to a survey for the Federal Emergency Management Agency. Many dam owners simply dismantled their aging structures rather than make repairs. But the survey says that only 21 states have adequate regulatory programs and that the rest are underfunded and undermanned.

For Joseph Ellam, Pennsylvania's director of dam safety, the situation is unsettling. "Catastrophic failures have occurred before, and they will occur again," he warns. "With the exception of nuclear power plants, no man-made structure has a greater potential for killing a large number of people than a dam."

The West Pinopolis Dam, 30 miles from Charleston, S.C., is one such dam.

Although the dam now is in good repair, earthquake experts believe it would fail in the event of an earthquake as powerful as the devastating Charleston earthquake of 1886, which killed 86 persons and caused panic as far away as Cleveland.

If the dam failed, some 2,000 residents along the Cooper River "wouldn't have any time to run for their lives," says Ronald Corso, the director of hydropower licensing for the Federal Energy Regulatory Com-

Please Turn to Page 18, Column 1

Article on Dams

## Flood Watch: The Safety of Some Dams Worries Officials Who Believe Earthquakes Pose Big Threat

*Continued From First Page*

mission. The flood would engulf the Charleston Naval Yard and the Atlantic Fleet's nuclear-weapons arsenal as well as a major industrial corridor, causing \$1 billion in damage. It would also clog Charleston's harbor with silt, closing a key port for the Navy.

The dam is vulnerable to an extraordinary phenomenon known as "liquefaction," Mr. Corso says. Seismic shock waves could "liquefy" the sand in the dam's foundation, turning it into quicksand or "mush." The shuddering dam would quickly slump, spilling the waters of Lake Moultrie in a thunderous rush.

The dam's owner, South Carolina Public Service Authority, also known as Santee Cooper, calls the chance of such a disaster remote, but the state-owned utility, under federal pressure, has agreed to strengthen the dam. "We don't care where they get the money so long as they fix it," Mr. Corso says.

### Other Worries

The energy regulatory commission has worries about more than 100 of the 2,000 dams it regulates and has ordered several utilities to make repairs. Montana Power Co., for one, is rehabilitating an ice-battered dam near Missoula to protect the Clark Fork River. It holds back tons of toxic smelting waste in the bottom silt. Mr. Corso says, "If you dump that waste down the river, it will be the biggest mess known to mankind."

The Tennessee Valley Authority has pared its list of unsafe dams to 14 from 21. Fixing Fontana Dam in western North Carolina is a high priority. At 480 feet, Fontana is the tallest dam east of the Rocky Mountains. The upper part of the dam needs reinforcing against a major earthquake. And an alarming 100-foot-long crack in the concrete has reopened and requires restitching with cables.

In Wyoming, Reclamation Bureau officials are keeping close watch on the badly leaking Fontenelle Dam on the Green River. The same sort of seepage that caused a near-failure in 1965 is undermining the dam. The officials are keeping the reservoir level as low as possible, rather than risk deluging Green River, Wyo., (population: 13,000), but they admit to being at "Mother Nature's mercy."

Last summer, so much melted snow came down from the mountains that officials couldn't discharge water fast enough to keep the reservoir from refilling. "We baby-sat that dam night and day," says one Reclamation Bureau official. "We had two bulldozer operators there 24 hours a day."

### Support Is Lacking

For years, federal officials in the field have been warning their superiors about Fontanella and other deteriorating dams. But cumbersome cost-sharing arrangements and resistance from the White House budget office have limited the Reclamation Bureau's efforts to a few projects. While the agency has begun budgeting more money for dam safety, many other projects will have to wait.

"It takes a long time to get momentum building behind a program, especially when it doesn't have high administration

support," says Neil Parrett, the bureau's chief of dam design. "We all could do better. But I celebrate the progress we've made to reduce the threat out there."

The Reclamation Bureau, like most of its regulatory brethren, has been slow to bring its substandard dams into compliance with the latest safety guidelines, as ordered by President Jimmy Carter in 1979. Federal dams should be stable enough to withstand the "maximum credible earthquake," usually defined as the quake from a known source like California's San Andreas Fault that could cause the most severe "vibratory ground motion" at a dam site.

Under the guidelines, federal dams should also have enough spillway capacity to discharge the "probable" maximum flood. Hydrologists calculate such a flood on the basis of the worst combination of meteorological and hydrological events likely to occur in watershed. In the Rockies, for example, it could be heavy rains mixed with a record snowmelt.

### The 'Overtopping' Problem

Several Reclamation Bureau dams, including four on the Salt River and two on the Verde River in Arizona, are vulnerable to "overtopping" by a superflood. The crucial dam is a national historic monument, Theodore Roosevelt Dam. If it were overtopped by the probable maximum flood on the Salt, the top of the dam would crumble, triggering a "domino effect," says the bureau's Mr. Parrett.

The flood would heavily damage two downstream dams, knock out a third and surge on toward Phoenix. "Phoenix gets drowned," Mr. Parrett says. An estimated 250,000 people would be flooded; property damages would hit \$9.5 billion.

The Corps of Engineers has made even less headway than the Reclamation Bureau, largely because of budget ceilings and high-level skepticism at the Pentagon about probable maximum floods. The corps under Mr. Gianelli undertook only two dam modifications between 1981 and 1984. In contrast, the much smaller TVA started five. Mr. Gianelli, now a engineering consultant in California, says that the corps could never explain to his satisfaction how it calculated the probable maximum flood.

Prado Dam, perched in a canyon above suburban Los Angeles, is one project that Mr. Gianelli held up. If the dam failed, the probable maximum flood on the Santa Ana River would inundate 1.3 million residents in Anaheim and other suburbs and cause as much as \$40 billion in damages, mostly in Orange County, according to the corps's risk assessment.

Mr. Gianelli, who served as California's water resources director under Gov. Ronald Reagan, remains unpersuaded. "That dam has been there 50 years," he says. "It has never filled to the point where the spillway is even used. You fix a dam if it's leaking."

### Delaying Repairs

In the private sector, meanwhile, dam safety continues to lag. Some farmers scoff at warnings that the dams they built with the Soil Conservation Service's assistance are about to flood out their neighbors. And many corporate dam owners put off costly

repairs.

"It's the last place anybody wants to spend money," says Gerald W. Farquhar, a Washington attorney. "Everybody says it'll be the other fellow's dam that goes."

Among state governments, money for regulating dams remains tight. While California leads the nation with a \$3.8 million budget and a 60-person staff, most states make do with much less—on average, \$265,000 a year. Some states, including Delaware, Alabama and Hawaii, don't yet have a semblance of a dam-safety program.

Pennsylvania, however, has accomplished more than most federal agencies, whittling its backlog of 208 unsafe dams to 72 in five years. More than \$50 million, including low-interest state loans, has gone into dam repairs, usually under consent agreements with the state. The Pennsylvania Gas & Water Co. has agreed to fix 16 water-supply dams, while the Greater Johnstown Water Authority has promised to fix or dismantle the Salt Lick Dam near the site of a famous dam-break nearly a century ago.

"If Salt Lick were to fail," says the state's Mr. Ellam, "it would be as bad as the great Johnstown Flood of 1889, the greatest catastrophe in U.S. history," that swept 2,200 persons to their deaths.